FIG. 1

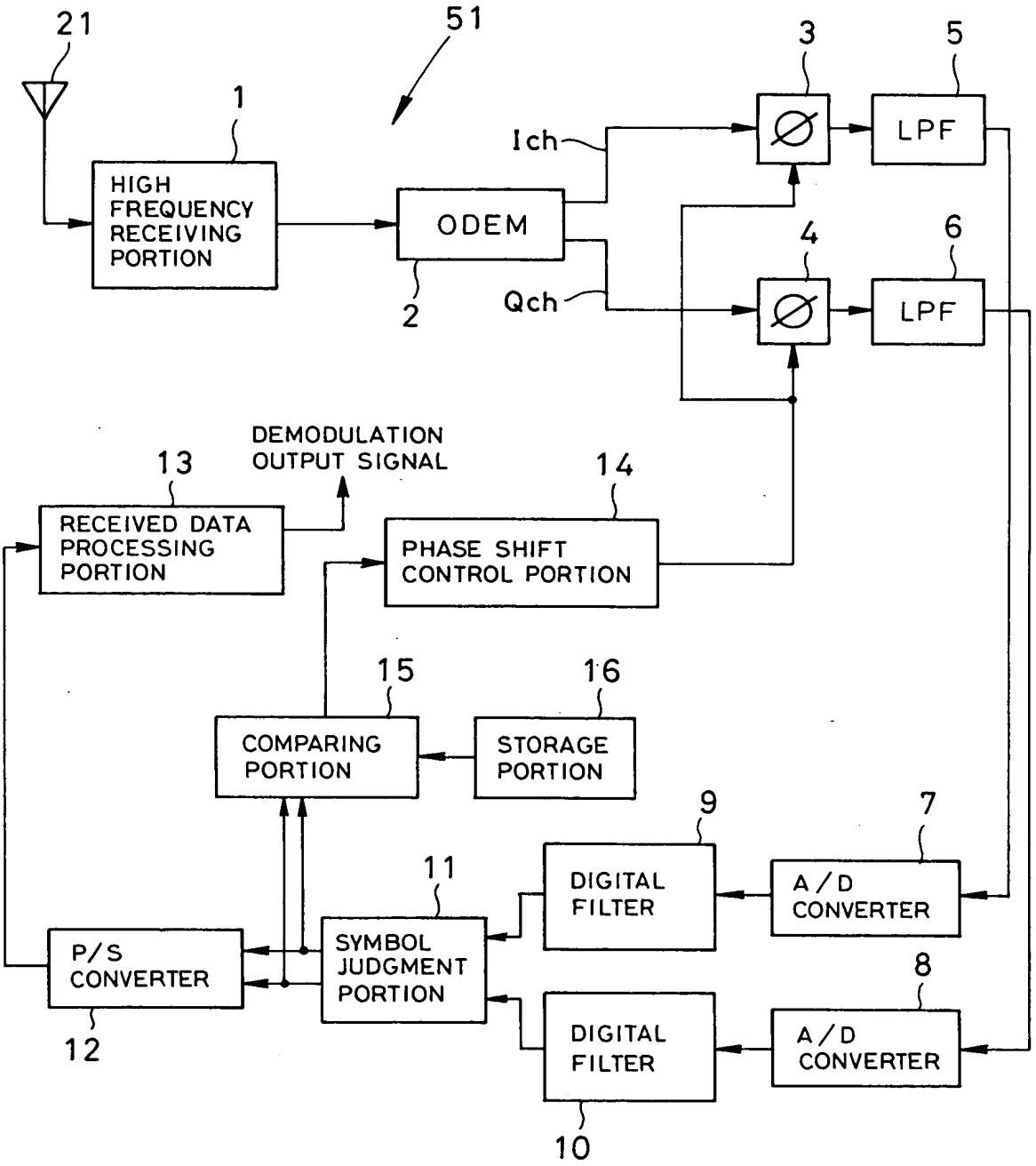

21
51
1
3
5
Ich
HIGH FREQUENCY RECEIVING PORTION
ODEM
LPF
4
6
2
Qch
LPF
DEMODULATION OUTPUT SIGNAL
13
14
RECEIVED DATA PROCESSING PORTION
PHASE SHIFT CONTROL PORTION
15
16
COMPARING PORTION
STORAGE PORTION
9
7
11
DIGITAL FILTER
A/D CONVERTER
P/S CONVERTER
SYMBOL JUDGMENT PORTION
8
DIGITAL FILTER
A/D CONVERTER
12
10

FIG. 2

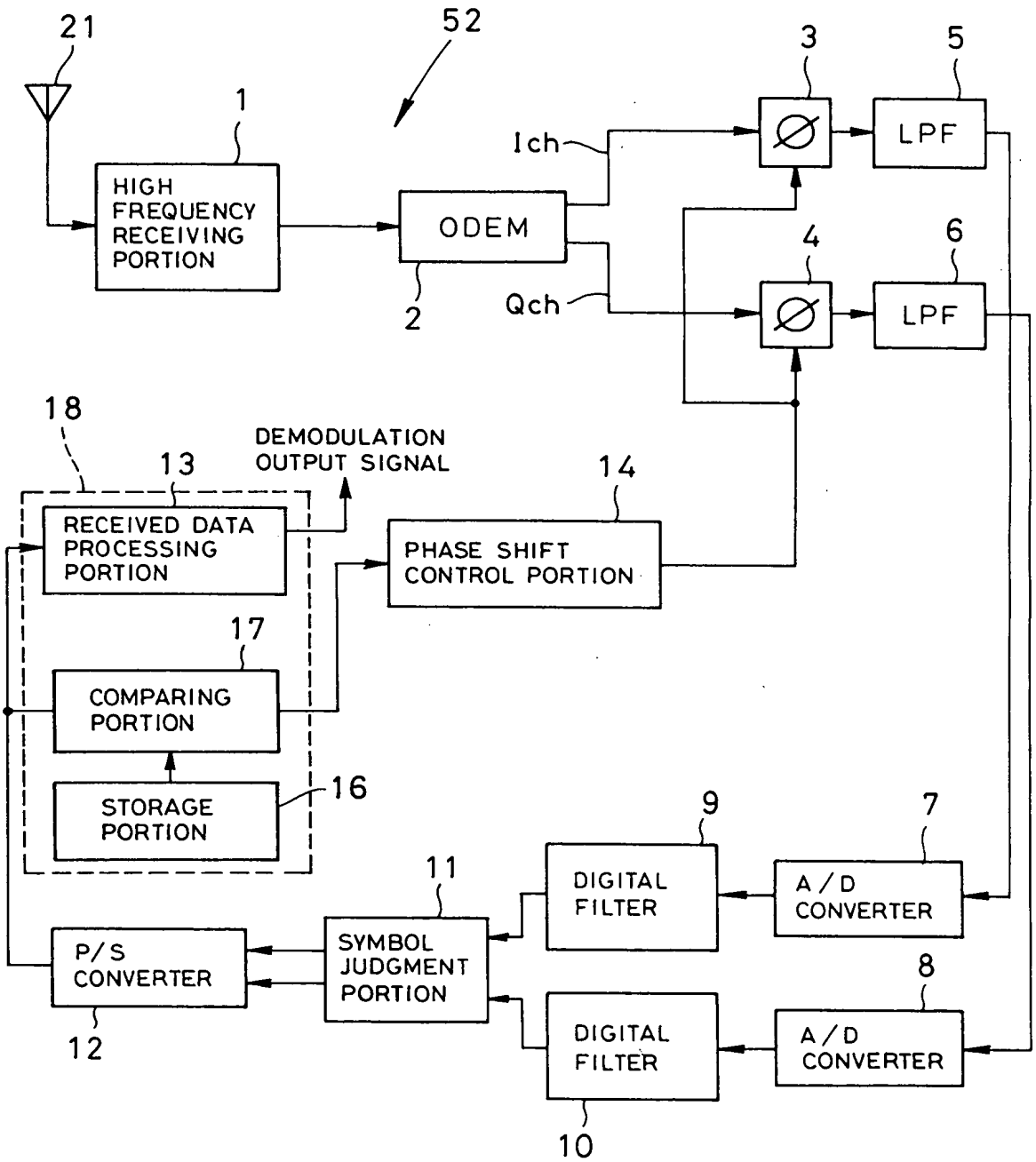

21
52
1
3
5
HIGH FREQUENCY RECEIVING PORTION
Ich
ODEM
LPF
4
6
2
Qch
LPF
18
DEMODULATION OUTPUT SIGNAL
13
14
RECEIVED DATA PROCESSING PORTION
PHASE SHIFT CONTROL PORTION
17
COMPARING PORTION
STORAGE PORTION
16
9
7
11
DIGITAL FILTER
A/D CONVERTER
P/S CONVERTER
SYMBOL JUDGMENT PORTION
8
DIGITAL FILTER
A/D CONVERTER
12
10

FIG. 3

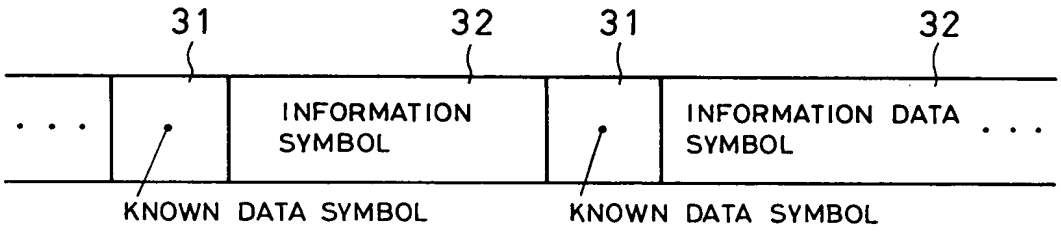

31
32
31
32
INFORMATION SYMBOL
INFORMATION DATA SYMBOL
KNOWN DATA SYMBOL
KNOWN DATA SYMBOL

FIG. 4

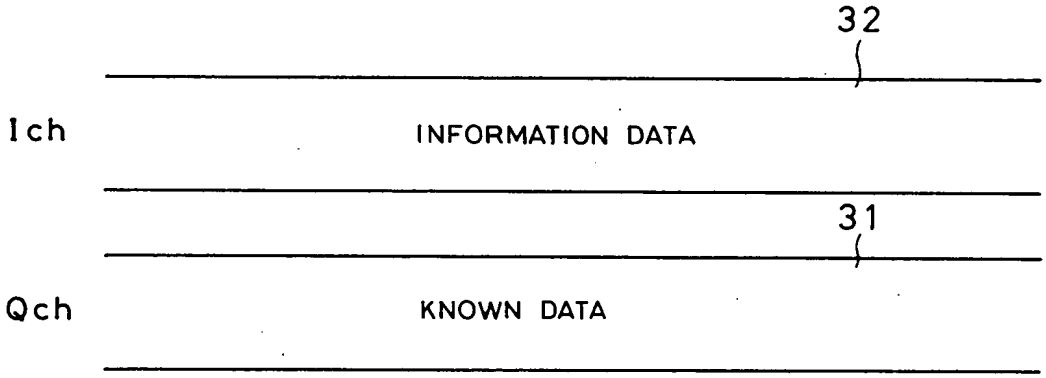

32
Ich
INFORMATION DATA
31
Qch
KNOWN DATA

FIG. 5

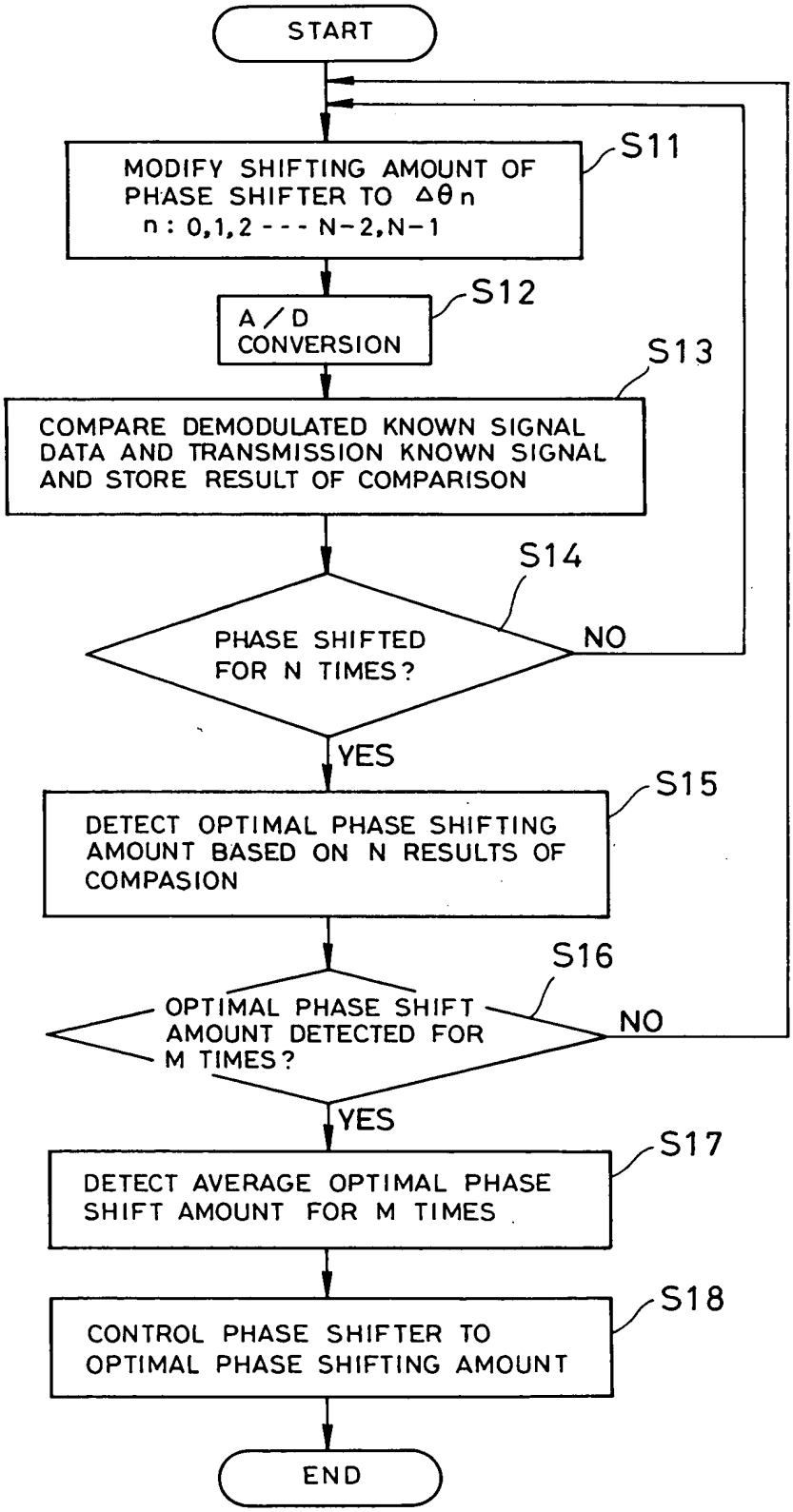

START
MODIFY SHIFTING AMOUNT OF PHASE SHIFTER TO Δθn
n : 0,1,2 - - - N-2,N-1
S11
A/D CONVERSION
S12
COMPARE DEMODULATED KNOWN SIGNAL DATA AND TRANSMISSION KNOWN SIGNAL AND STORE RESULT OF COMPARISON
S13
PHASE SHIFTED FOR N TIMES?
S14
NO
YES
DETECT OPTIMAL PHASE SHIFTING AMOUNT BASED ON N RESULTS OF COMPASION
S15
OPTIMAL PHASE SHIFT AMOUNT DETECTED FOR M TIMES?
S16
NO
YES
DETECT AVERAGE OPTIMAL PHASE SHIFT AMOUNT FOR M TIMES
S17
CONTROL PHASE SHIFTER TO OPTIMAL PHASE SHIFTING AMOUNT
S18
END

FIG. 6

SAMPLING TIMING PHASE DIFFERENCE	θ1	θ2	θ3	---	θN-2	θN-1	θN
CORRELATION VALUE	r1	r2	r3	---	rN-2	rN-1	rN

FIG. 7

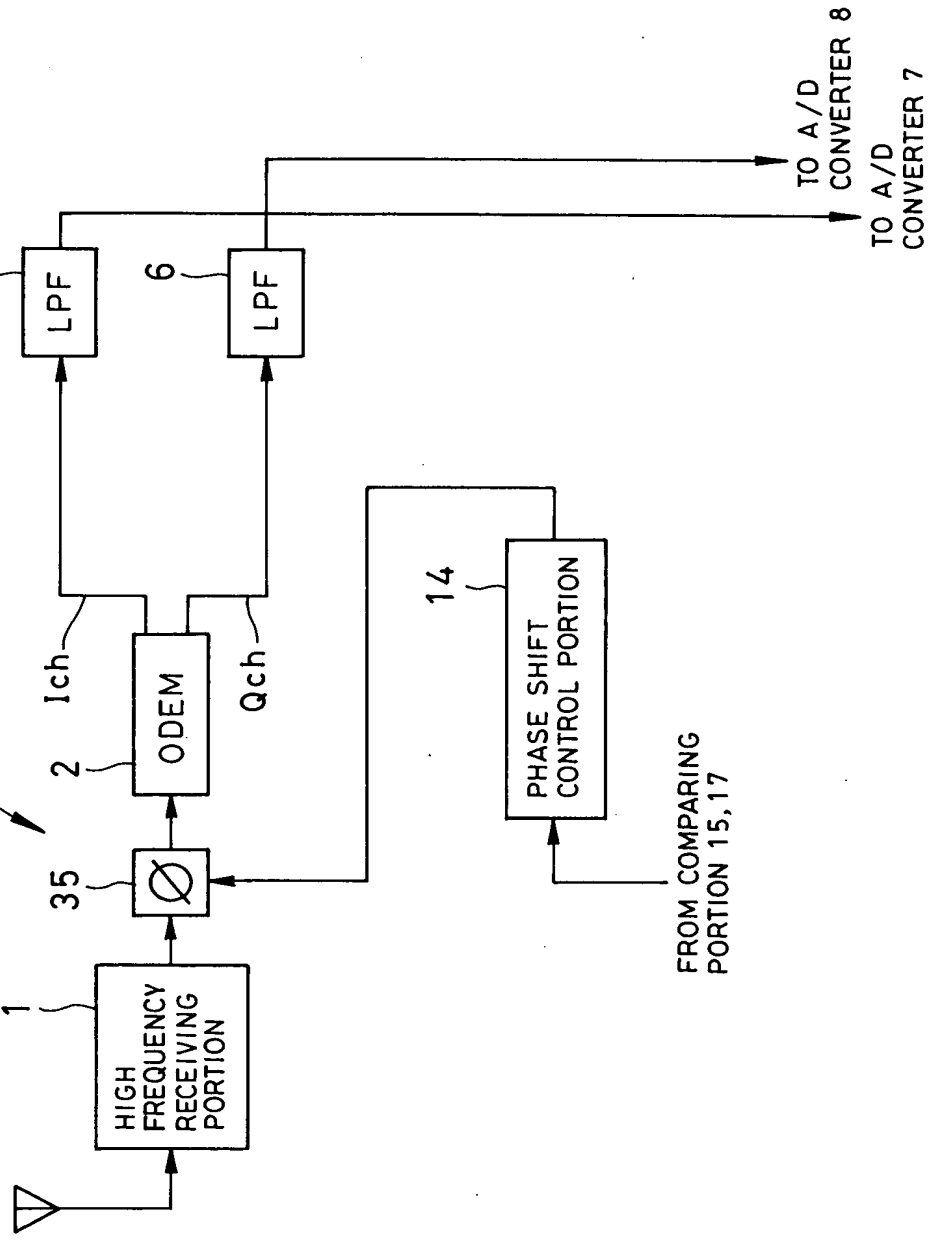

53
1
HIGH FREQUENCY RECEIVING PORTION
35
2
ODEM
Ich
Qch
5
LPF
6
LPF
TO A/D CONVERTER 8
TO A/D CONVERTER 7
14
PHASE SHIFT CONTROL PORTION
FROM COMPARING PORTION 15,17

FIG. 8

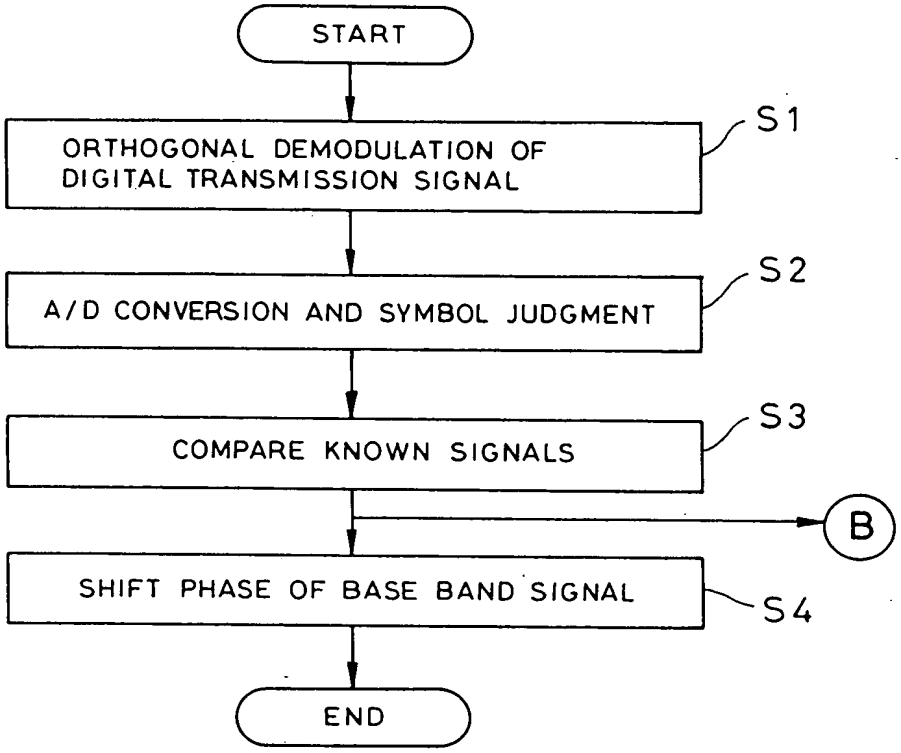

START
ORTHOGONAL DEMODULATION OF DIGITAL TRANSMISSION SIGNAL
S1
A/D CONVERSION AND SYMBOL JUDGMENT
S2
COMPARE KNOWN SIGNALS
S3
B
SHIFT PHASE OF BASE BAND SIGNAL
S4
END

FIG. 9

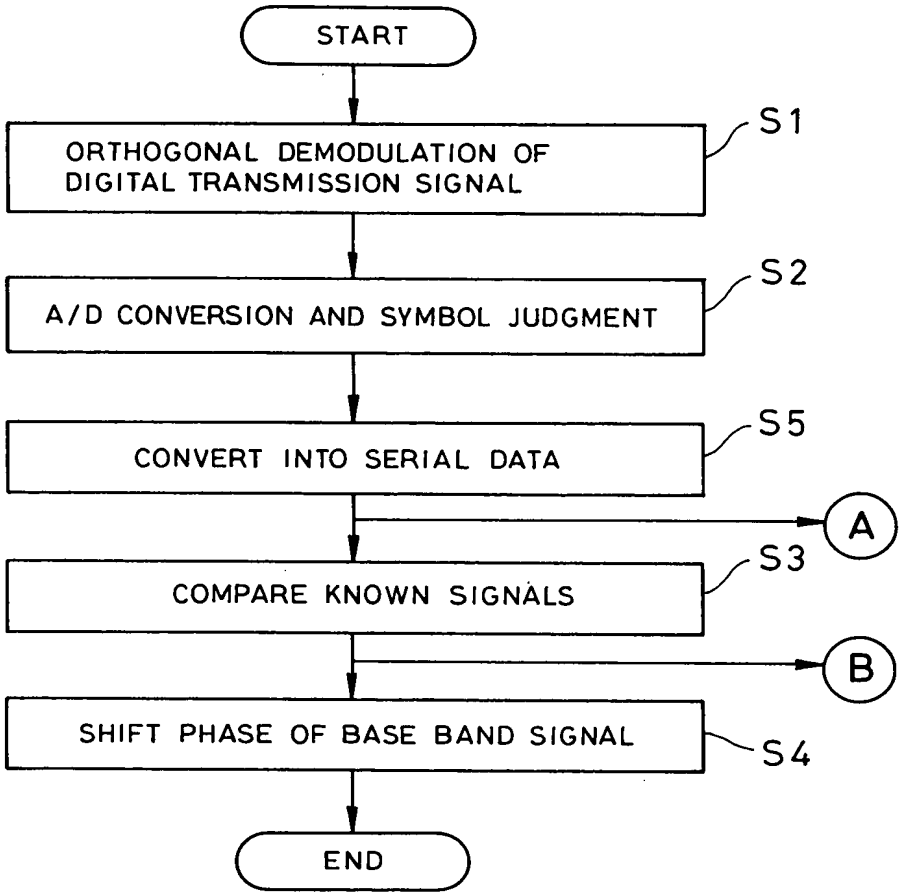

START
ORTHOGONAL DEMODULATION OF DIGITAL TRANSMISSION SIGNAL
S1
A/D CONVERSION AND SYMBOL JUDGMENT
S2
CONVERT INTO SERIAL DATA
S5
A
COMPARE KNOWN SIGNALS
S3
B
SHIFT PHASE OF BASE BAND SIGNAL
S4
END

FIG.10

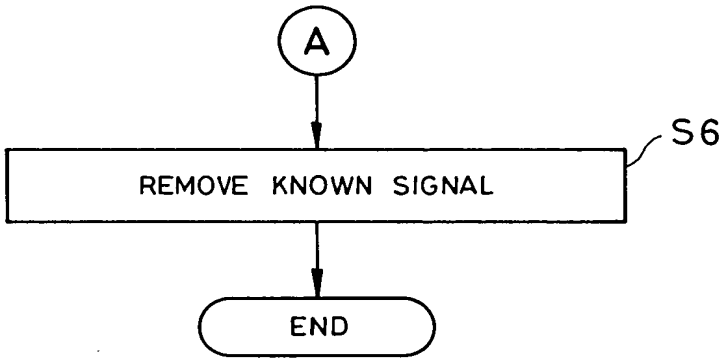

A
S6
REMOVE KNOWN SIGNAL
END

FIG.11

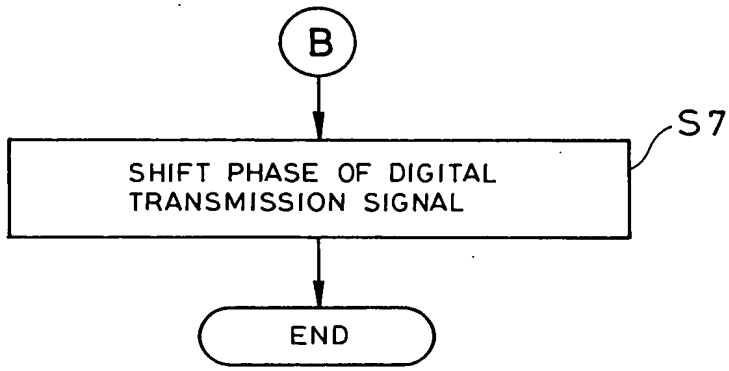

B
S7
SHIFT PHASE OF DIGITAL TRANSMISSION SIGNAL
END

FIG.12

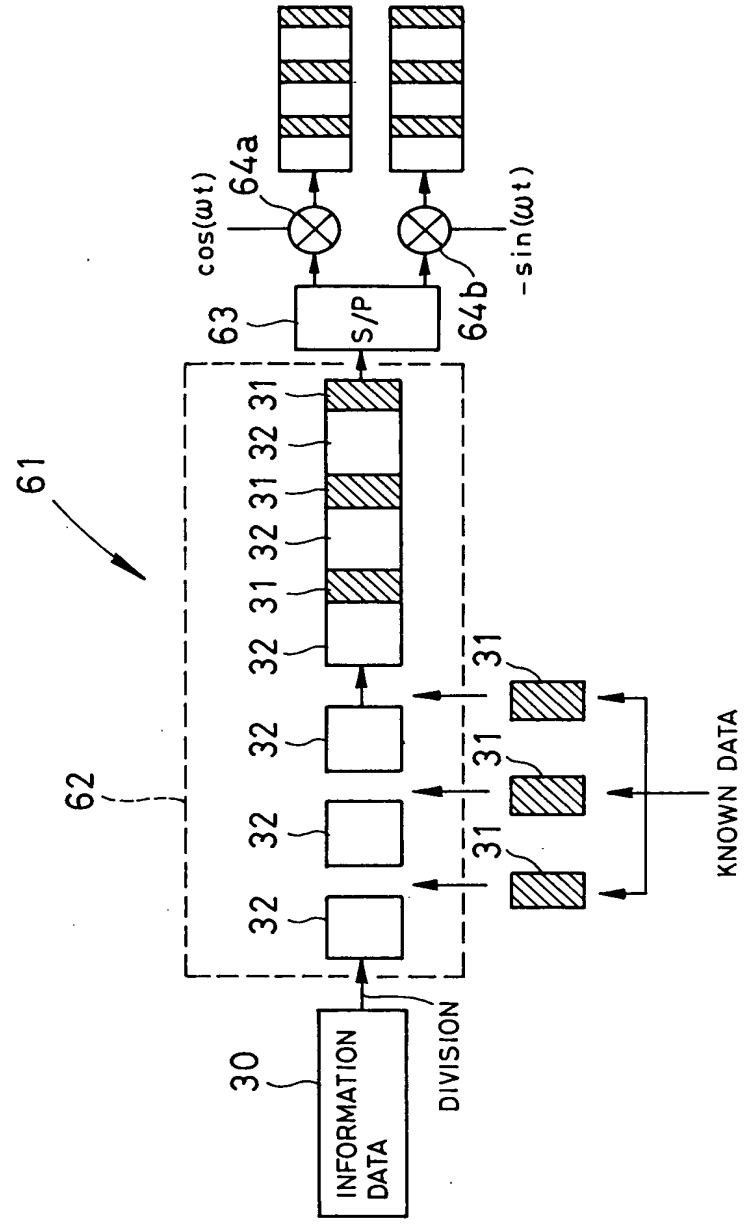

30
INFORMATION DATA
DIVISION
61
62
32
31
63
S/P
64a
64b
cos(ωt)
-sin(ωt)
KNOWN DATA

FIG.13

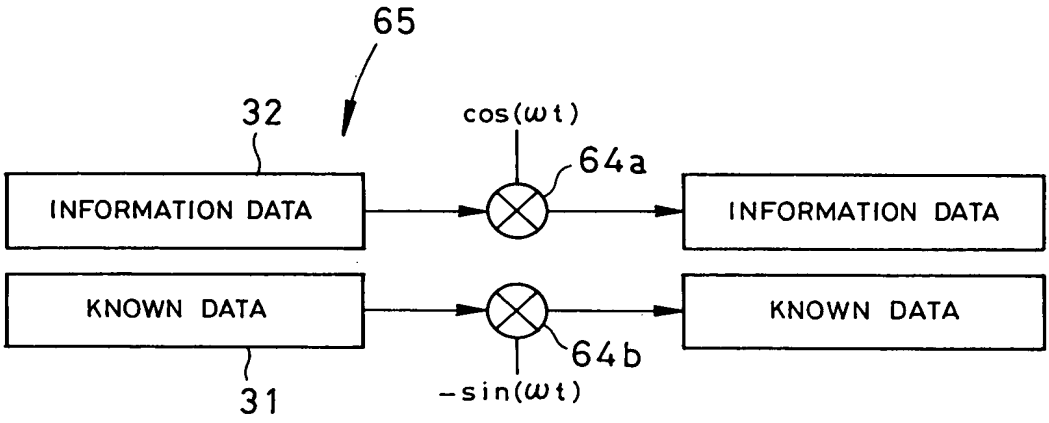

65
32
cos(ωt)
64a
INFORMATION DATA
INFORMATION DATA
KNOWN DATA
KNOWN DATA
64b
31
-sin(ωt)

FIG.14

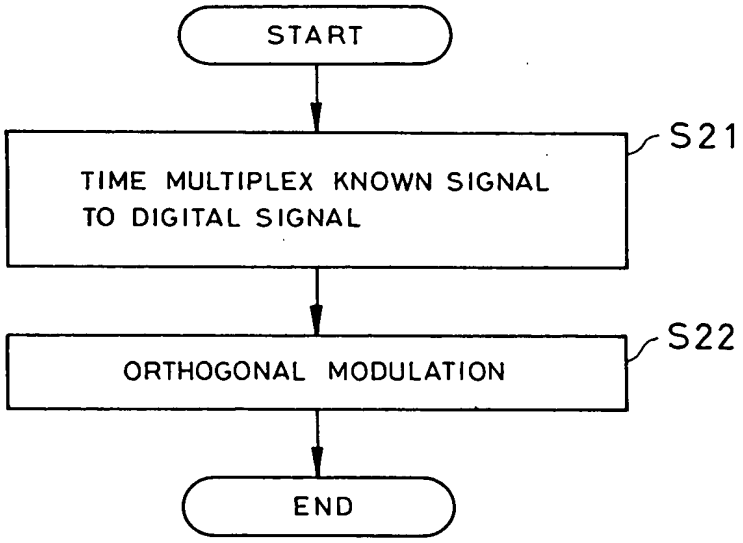
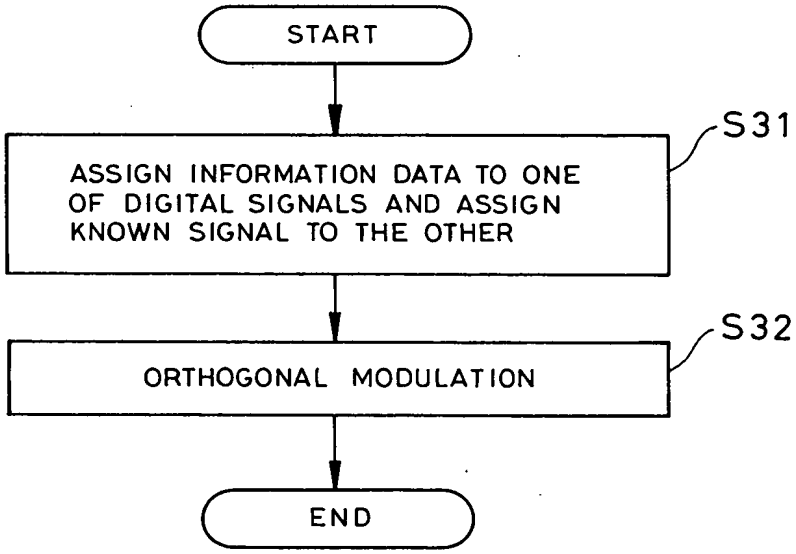

START
S21
TIME MULTIPLEX KNOWN SIGNAL TO DIGITAL SIGNAL
S22
ORTHOGONAL MODULATION
END

FIG.15


START
ASSIGN INFORMATION DATA TO ONE OF DIGITAL SIGNALS AND ASSIGN KNOWN SIGNAL TO THE OTHER
S31
ORTHOGONAL MODULATION
S32
END